# The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. XLVII
No. 1201

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# The Chemical Age

**A Weekly Journal Devoted to Industrial and Engineering Chemistry**

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# Reconstruction

POST-WAR reconstruction comprises two aspects: the material work of rebuilding damage properties and of providing additional improvements in the form of slum clearance, increased educational facilities, and the like; and the more difficult problem of increasing the trade of the world to such an extent that the available machinery and labour force may be fully occupied. We have discussed many aspects of these problems during the last few months and it would seem that the ideas of business men and statesmen throughout the world are beginning to crystallise. The views that we have expressed have been echoed, for example, in the Report on Reconstruction issued by the Federation of British Industries. It is there laid down that the Democracies must ensure the future peace of the world, that the great task which lies ahead of us to preserve a reasonable standard of life can be achieved only by hard work, that continuing international co-ordination is needed to carry out tasks of reconstruction, and that the immediate task after the war will be to provide the stricken countries of the world with the first essentials of life and the wherewithal to restore their essential economic machinery. The economic systems of the world must be re-created in order to achieve world prosperity.

It is thus becoming recognised that the path to sound economic reorganisation and to the avoidance of the disastrous trade slumps that have hitherto followed every great war in history, lies in increasing the standard of living of the backward countries so that their purchasing power can in turn be added to the limited purchasing power of the comparatively few countries that have already a reasonably high standard of living.

The Federation also urges that the Treasury should permit adequate financial reserves to be built up for post-war development, that some measure of Government control over industry must be maintained, that the prosperity of agriculture must be ensured, that orderly demobilisation must be carefully considered in order to avoid flooding the labour market, and in other respects that Government policy should be formulated in such a way as to prevent unnecessary

## On Other Pages

disturbance and to ease the flow of business by maintaining, for example, the the power of the home market to consume large quantities of manufactured goods. There is no doubt that the organisation of the home industry and of the home markets is important. The British nation has hitherto been immensely wealthy and has purchased goods at a very high rate; it is obviously necessary that this rate should be maintained if at all possible.

Care must be taken, nevertheless, not to lay too much emphasis on home affairs. Quite obviously the Federation of British Industries is right in all its submissions as regards the home market, and as regards the need for letting manufacturers strengthen their resources against the aftermath of war. Experience shows, however, that in the light of the disappearance of many of our overseas assets in order to pay for the war, and in view of the very high population density of this country, our standard of living cannot be maintained unless international trade is made to flow more freely than it did between the years 1918-1939. The submission is made by the Federation to the effect that a common policy between the United Kingdom, the Empire, and the U.S.A. is essential, and must be the keystone of post war reorganisation. Most of our difficulties in the inter-war period and, in the view of many, the reopening of hostilities in 1939 were due to insufficient international collaboration between the great industrial nations of the world. In some respect Russia is a law unto herself; Russia is still in a state of development and, by reason of her vast resources and lower standard of living, can be to a large extent self-sufficient. The rest of the world, however, will desire Russia to be included in any arrangements that may be made if only as a safeguard for the future. Great Britain, the Empire, and the U.S.A. between them hold the key to international prosperity during the next 20 or 30 years. The isolationist policy of America after the last war appears now to be understood in that country to have been a mistake, and there seems to be every probability that America will for the future regard herself as one of the nations of the world in the same sense as we do ourselves. Mr. Cordell Hull, in his last note to Japan before Pearl Harbour, invited Japanese co-ordination in economic policies which, among other things, contemplated "the establishment of such institutions and arrangements of international finance as may lend aid to the essential enterprises and the continuous development of all countries and may permit payments through processes of trade consonant with the welfare of all countries." The implication of this invitation was that backward nations might borrow to promote their essential enterprises and continuous development, and should discharge their obligations by payment in the goods or services which they could supply.

A suggestion has been made in America by Mr. Herbert Feis that states such as the U.S.A. and Great Britain should set aside credits for the backward countries which should be used for development and which would be paid back by goods or services in the currency of the country concerned within a limited time. If the time—two years was suggested—elapsed without demand for these payments, the credits would automatically lapse. The difficulty before the war was that creditor countries insisted upon payment in their own currency and at the same time made it very difficult for the debtor countries to obtain it. Mr. Feis's suggestion avoids this dif-

## Reconstruction

*No more appropriate title could be devised for the leading article in this number with which we begin our thirteenth century. No more suitable date than the Fourth of July could have been chosen on which to assert our independence of the old traditional form of* THE CHEMICAL AGE. *Our readers will require no explanation of this change; to waste space on such verbiage would be to defeat the very object with which the change is being made. We should, however, like to assure them that the change is purely one of form. It is our hope and belief that we shall be able to maintain the quality of our contents at its normal standard, and perhaps even manage to increase the quantity of the material contained within our covers.*

ficulty by accepting the argument that equilibrium can best be restored and maintained by adopting the principle that international monetary obligations should be capable of liquidation in the currency of the country from which payment is due. The system would put the onus of redressing any lack of balance on the countries with surplus balances instead of, at present, on the "deficit" countries. The "surplus" countries, in order to recover their money, would call for goods and services on an increased scale and thus international trade would be promoted. Under the old system the "deficit" countries endeavoured to restrict their adverse trade balance by importing as little as possible from the "surplus" countries. This was quite obviously wrong because it led to restraint of trade. Mr. Feis's suggestion, on the other hand, would lead to increased trade.

While we cannot, without over-optimism, say that the post-war position appears bright, we can at least discern a general movement among the greater democratic nations to take concerted action to increase the flow of international trade after the war. We can also discern, among the many and often conflicting opinions and suggestions that are made, an appreciation of the major difficulties involved and many suggestions whereby they may be overcome. We are frankly more hopeful than we have been for a good many years that out of the present struggle there will emerge a sound international system of trading which will increase the standards of living all over the world, and will once for all stop the vicious system, which has held sway for so many years, whereby the consumption of goods is limited by purchasing power, the manufacture of goods is restricted, and foodstuffs are destroyed in some parts of the world because people elsewhere cannot afford to pay for them.

# NOTES AND COMMENTS

## Chemical Engineering Courses

THOUGH his paper, presented at the recent meeting of the Institution of Gas Engineers, was naturally directed mainly towards the gas industry, Professor D. T. A. Townend's remarks on university courses in chemical engineering will bear study by technologists of many and varied kinds. Speaking on the foundation of a four-year chemical engineering course at Leeds University, on lines similar to that instituted a year or so ago at the Imperial College, he pointed out that "it has to be remembered that science knows no hard and fast distinctions, and frequently it is difficult to decide whether a subject comes best under the heading of, say, physics, chemistry, or engineering." He stressed, therefore, the importance of making the training in a technical industry broad enough to provide its leaders with an adequate understanding of the whole field embraced by it. But, as he further stated, there is something to be considered beyond university courses, however well arranged these may be. "No young man," said Professor Townend (and we heartily agree with him), "can become fully qualified without a period in works"; experience at Leeds has shown that it is usually an advantage for the student to secure this *before* passing on to the university. Another important part of a university course is the arrangement of lectures by outside experts in technology; there is no better means of keeping pace with the rapid progress of science, and an opportunity is provided for those already in industry to attend refresher lectures.

## "Dry Ice" in Industry

"EVERY little helps" must be the motto of the Government at this stage of our war economy and if, as the Food Ministry has announced, we are to have no ice-cream after September 30, we can accept this new deprivation in the spirit that, even if no great saving in materials were thereby effected, the austere policy which dictated the move is good. There is, however, apart from the plant, labour, and packing materials involved, at least one important industrial substance connected with ice-cream distribution which might well be directed into more vital channels. This is carbon dioxide which, in solid form, is still used to some extent for keeping ice-cream at the only temperature thinkable for this delicacy. "Dry ice" was, of course, used on a much bigger scale before the war when the roads in summer were never without their chain of tinkling tricycles full of ice-cream. Large quantities of carbon dioxide went into the trade in those days. But now the shops that sell ice-cream are often equipped with an electrical freezing appliance, and there are few mobile vendors on the roads. Neverthe-

less, the comparatively small amount of carbon dioxide released by the new order will be of great value to our war industries, where it is used extensively in the manufacture of all kinds of instruments which are required to resist low temperatures. It also plays a part in the testing of aeroplane engines built for high altitudes.

## From Business Man to Bureaucrat

IN a recent article in *Truth* about "The Business Bloke," Sir Ernest Benn has some caustic things to say of the men who forsake business for bureaucracy, to a lasting disadvantage in the conduct of affairs in both worlds. Sir Ernest says that the ideal business man is the fellow who knows his job and sticks to it for, he adds, "there is generally much more in the job than can be learnt in a single lifetime." The wartime shake-out in our economic system provides a unique opportunity for the man who, from conducting the affairs of an industrial concern in the city, has ambitions to enlarge his field of influence by moving west to Whitehall. What he does not seem to realise, as Sir Ernest points out, is that the bureaucrat and the business man do not belong to the same world. "The former works behind the force of law," he says; "it is not his business to consider his customer; he has merely to issue the form and, should the details fail to be forthcoming within the seven or twenty-eight days prescribed by the Act, to follow it up with a summons. The latter lives by the favour of his customer, and, if he would succeed, every moment of his waking hours must be devoted to the study of better ways of serving and thus winning further favour." There might appear at first to be some contradictoriness in this argument. If the business man's way is to serve, does this not imply that he will make a better bureaucrat than many officials who have forgotten that they are public servants? Unfortunately, the answer is "No." Most of the men who move from business to bureaucracy regard the change not as an opportunity to transfer some of their sound business principles to the conduct of affairs, but as a sort of promotion which carries with it the obligation to continue in the tradition of the august place to which they have been called.

## After the War

THIS tendency is bad enough for its effect during the war, but Sir Ernest Benn draws certain conclusions which bode ill for the economic position of many after the war is over. He talks of the "scorched earth policy at home" conducted by those who, "having sent the soldiers on, have remained behind to destroy the way and means of life for the maintenance of which the soldiers are fighting." The wholesale closing down of businesses has liquidated employers with statutory obligations to take their men back after the war. This is a truth which, in the absence of concrete assurances from those in power, must have come home sharply to many now serving in the Forces. And, while the world of still-active business shrinks, the herds of officials appointed to watch and gloat over its annihilation grow; until we can envisage a time when the last remnants of an erstwhile prosperous business world will finally be suffocated out of existence by a blanket of officialdom which has nothing else to put in its place. It seems probable that before that stage is reached, even the bureaucrats will see the danger signal and the usual appeals will be made to the patriotism of their victims in order to retrieve something from the wreck. The question arises as to what extent the business men who have forsaken their calling in industry will be fit to resume their places after a period of power without responsibility.

## Fewer Trees

CHEMISTS with a flair for the history of their subject must expunge from the tablets of their memory the name of that noble lady, the Countess of Chinchón. It now appears, from a monograph by A. W. Haggis, of the Wellcome Historial Medical Museum, in the *Bulletin of the History of Medicine*, that this lady was not cured of malaria by "Peruvian bark" (or whatever it was); in fact it seems certain that she never heard of the drug; and if cinchona was named after the Spanish village from which she took her title (and there now appears no reason why it should have been), it was not because of any incident in her life. The trouble about the name "cinchona" seems to have originated in a confusion between Peruvian balsam (*Myroxylon pereiræ*) and the genus *Cinchona*. This confusion was perhaps intentional, because the cinchona bark originally imported into Europe was illicitly brought in as a substitute for Peruvian balsam bark. This last was the original quinaquina of Peru (which, by the way, always irresistibly reminds us of the mysterious drinks that the habitués used to order in French cafés); whereas the cinchona was described in the early 17th century as the "Fever Tree." Writers from then on have confused the issue by attributing peculiarities of one tree to the other, and vice-versa, lacking precise knowledge of either. Mr. Haggis has now put them both in their right genera, but he does not xeplain the fever trees which "the grey-green, greasy, Limpopo river" was "all set about with." Also, we frankly regret having to throw the Countess overboard.

# Gas Producers

## War-Time Problems: Post-War Possibilities

[*From a Special Correspondent.*]

THE manufacture of producer gas is becoming of increasing importance, partly as a war emergency measure and perhaps partly as a general method of manufacturing combustible gas for industrial heating operations. There is diversity of opinion as to the economics of using producer gas as compared with town gas from gas works for the same purpose. On the one hand town gas is virtually free from impurities, containing very small quantities of sulphur and no dust or tar. On the other hand the cost per therm of manufacturing producer gas is generally cheaper than the cost of purchasing coal gas. A recent passage in the paper by Mr. J. G. Bennett on "The Future of Coke" stated that it was very doubtful whether it would ever be practicable to manufacture and distribute town gas at much below 4d. a therm. The present position is that large gas-fired furnaces, particularly open-hearth steel and glass-melting furnaces, are normally fired with hot raw producer gas costing about 1½d. per therm, except in the Sheffield area where coke-oven gas is used. A fresh wave of interest in producers has been created by war conditions, which make it desirable to have an alternative supply of gas. Small gas producers are being installed which give a gas of 125 to 140 B.Th.U./cu. ft. with ordinary gas coke and are cheap and easy to operate.

### Gas Coke

A parallel development is the replacement of petrol by the use of producer gas for road transport, made from anthracite or coke of special quality and size. In the early stages of this development it appeared that anthracite would be the preferred fuel, but in the past year the emphasis has shifted markedly towards gas coke of special quality treated with sodium carbonate to give high reactivity. Alkali-activated gas coke and specially prepared low-temperature cokes appear to be the best fuels for operating portable producers. The importance of this development was also referred to in Mr. Bennett's paper (*loc. cit.*) when he pointed out that in 1913 we exported coal to the value of £50,700,000 and imported petroleum products to the value of £10,800,000, whereas in 1938 we imported petroleum products to the value of £43,300,000 and exported coal to the value of £39,000,000. Thus a favourable trade balance in fuels of £40,000,000 has been converted into an unfavourable balance of £4,000,000. Bearing in mind that the prosperity of this country before the first world war was largely based on our capacity to make foreign investments and purchase raw materials bought by means of our coal exports, the situation as it existed at the outbreak of the second world war must be regarded as extremely serious. The disappearance of our foreign assets as a result of the war makes the position far worse, and we are bound, if it is technically possible, to reduce our dependence upon liquid fuel imports for many years to come.

### Government Scheme

Upon the economics or the politics of these developments we do not propose to comment here at any length. It is sufficient to point out that the traction gas producer has been under development by specialist firms for many years and it has recently been stated that satisfactory producers were available for the purpose ten years before the war. The Government however, did not take advantage of the experience thus gained, but rejected existing producers (after trials at the Fuel Research Station) either on the ground that they were unsuitable for mass production or because they did not give sufficiently good results in practice. It was thereupon decided to design a Government Emergency Producer with the aid of a committee which, so far as we are aware, did not include representatives of the firms which had specialized in that class of work. The result was a producer which was tried last summer and which failed. Thus after two and a half years of war nothing practical has been done to replace petrol by home produced fuels. A second Government Emergency Producer has now been put forward and, according to recent Government statements, 10,000 vehicles were to be equipped with these immediately. This proposal, however, was defeated in the House of Lords by an alternative amendment that 50,000 vehicles should be equipped immediately.

The British Coal Utilization Research Association has also been developing a producer that is apparently regarded by most people as satisfactory. The Mobile Gas Producers' Association, for example, which includes all the established manufacturers

of proprietary traction gas producers, has agreed as a war expedient to turn over their plants to the manufacture of the British Coal Utilization Research Association's producer if the Government will give them the necessary instructions and opportunities. According to some views there has been a quite inexplicable side-tracking of established commercial interests in favour of an invention sponsored by the Civil Service. At all events, the fact remains that an immense volume of work is being done to bring the traction gas producer to commercial development. In addition to the Fuel Research Board and British Coal Utilization Research Association, the Gas Light & Coke Company, the Birmingham Corporation Gas Department, I.C.I., Ltd., the Institution of Automobile Engineers and other bodies have been busily engaged in investigating this problem. One difficulty has been that of necessity, and as a wartime expedient experimenters have had to adapt petrol engines for the purpose. The outlook will be changed altogether if lorries and buses are designed *ab initio* for the use of producer-gas fuel, following a few years of large-scale development work such as has been practicable with the petrol engine and the diesel engine. The importance of all these developments is that the opportunity for this work is being enlarged and we may at a later date find that, with full freedom in the selection of their fuels, transport companies will select gas-producer vehicles in preference to petrol-driven vehicles. So far as can be seen the deciding factors when development is completed will be the lower running cost of the producer-gas vehicle as compared with the greater ease of operation and servicing of the petrol-driven vehicle.

## Research in Progress

An important paper, read before the Institute of Fuel by Dr. S. G. Ward, of Birmingham University, and Mr. W. J. Morison, of Messrs. Thomas Tilling, Ltd., indicates that large-scale research, aided by scientific research at a university, has also been in progress in yet another direction and has succeeded in introducing a practical gas-producer service for buses in East Anglia by obviating in the design of the producers some of the faults which were causing difficulties.

The problem of producer-gas production, whether for industrial heating or for traction gas producers is twofold: (*a*) Production of the raw gas and (*b*) purification of the gas. For many purposes the gas can be used in its hot impure state and in this way the sensible heat of the hot producer gas, and the heat of combustion of the tar which it contains when made from coal are added to the potential heat of the cold clean producer gas. If tar is regarded as a disadvantage the producer gas can be made from coke.

Turning first to the manufacture of producer gas there have been developments over the past few years which have given a different picture to the process. It was formerly considered that the manufacture of producer gas could be divided into two

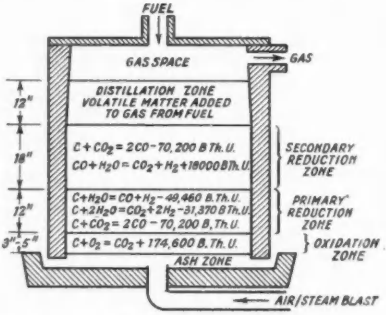


**Fig. 1. Producer reaction zones**

simple stages, in the first of which carbon dioxide was formed by direct combustion, and in the second this gas, with any water vapour that might be introduced in the blast, was reduced to form carbon monoxide and hydrogen. It is now known that this picture is too simple. The reactions which occur in the producer are complicated, and conditions favourable for these reactions must be maintained carefully if the best gas is to be made.

A coal-fired producer may be divided into six zones, each of which has an important part to play in the production and composition of the gas. At the extreme bottom of the producer is the zone of ash. If this ash zone forms a dense clinker the working of the whole producer will be impaired. If on the other hand it forms a bed of reasonably-sized particles it will assist in distributing the air-steam blast which is supplied under the grate. If the coal has a low melting ash it will tend to form clinker. The formation of this clinker takes place in the next higher zone, which is termed the oxidation zone (Fig. 1). Here the essential reaction is that of the formation of $CO_2$ by direct combustion of the carbon with the oxygen of the blast. It is essential that a very high temperature be maintained in this zone, because, as will be shown, upon the maintenance of a sufficiently high temperature in the reduction

zones succeeding depends the success of the process.

The heat thus generated would be sufficient to fuse almost any coal ash if a straight air blast were introduced. Partly to mitigate the extreme temperatures and partly to improve the calorific value of the gas, steam is added to the air blast so that a steam-air mixture is used. The effect of steam, as will be seen later, is to cool the oxidation zone and thus to reduce the tendency to clinkering. It was formerly believed that if a coal with ash of too low a melting-point was used the remedy was to use more steam in the blast. This is now regarded as undesirable. In the oxidation zone heat is liberated that must serve to operate the whole process, and drastic reduction in temperature by steam to prevent clinker formation from low-fusing ashes would be detrimental to the later reactions.

In the third zone, which is known as the primary reduction zone, endothermic reactions take place (see Fig. 1). No doubt some of the steam is decomposed in the oxidation zone, thus causing its effect on the fusion point of the ash and on the temperature of this zone. The reactions which take place up to this stage are dependent on the two factors of time and temperature. Fig. 2 indicates that the speed of these reactions will depend upon the reactivity of the material, charcoal being very much more reactive than coke, for example; low-rank high-volatile non-coking coals yield a coke more reactive than higher-rank coking coals; semi-carbonized material which would

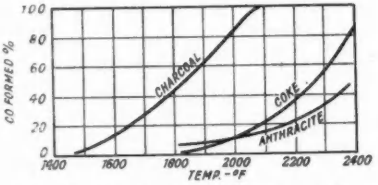


**Fig. 2. Formation of CO from $CO_2$. Time of contact = 1 second**

be formed in this zone in a coal-fed producer is also highly reactive; high-temperature coke is unreactive. The less reactive the solid fuel the higher must be the temperature to enable the reaction to proceed sufficiently far with the same time of contact. Thus the small traction gas producer *must* have highly reactive fuel.

Fig. 3 illustrates the primary point that the extent to which a reaction takes place depends basically on the temperature. At 900° C., for example, the equilibrium mixture of $CO_2$ and CO in contact with coke should contain 3.4 per cent. $CO_2$ and 96.6 per cent. CO, but, as the figure shows, even after 80 seconds there is still less than 20 per cent. of CO in the mixture. At 1300° C. the mixture should contain less than 0.1 per cent. of $CO_2$ and it actually reaches something very near equilibrium after only five seconds. It will now be evident why it is inadvisable to increase the steam and so to reduce the temperature in order to overcome difficulties with low fusion ash. It is

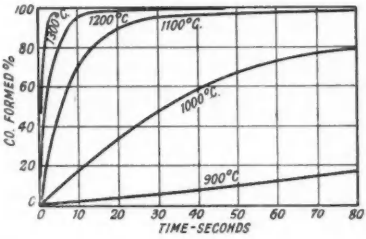


**Fig. 3. Time-temperature reactions in formation of CO from $CO_2$ and coke**

obvious that in the primary reduction zone the reaction $C+H_2O=CO+H_2$ is to be preferred to the reaction $C+2H_2O=CO_2+2H_2$ because $CO_2$ in the gas is waste of fuel. The reaction between carbon and water is almost entirely confined to the first of these reactions at temperatures above 1000° C. and to the second of these reactions at temperatures below 600° C. Consequently, it is obviously important that the temperature should be above 1000° C. Actually the temperature should be even higher than this because of the effect of temperature on the velocity of the reactions.

As the gas leaves the primary reduction zone it passes into the secondary reduction zone, where the temperature will obviously be lower partly because of the reduction in heat due to the endothermic reactions in the primary reduction zone and partly owing to the absorption of sensible heat from the gases by the solid fuel descending from above. There will be a tendency for $CO_2$ to be reduced to CO, as is shown in Fig. 1, but with a reduced temperature this tendency will not be very marked. The important reaction from now onwards is that which takes place between CO and $H_2O$ (Fig. 1). This is a reversible reaction which starts at about 500° C. and which, so far as equilibrium is concerned, proceeds from right to left with increasing temperature.

The values of K in the expression

$$(CO)(H_2O)/(CO_2)(H_2)=K.$$

| °C. | K. | °C. | K. |
|---|---|---|---|
| 786 | 0.81 | 1086 | 1.95 |
| 886 | 1.19 | 1205 | 2.10 |
| 986 | 1.14 | 1405 | 2.49 |

It is evident that in order to preserve the CO first formed it is desirable that as little undecomposed steam as possible should be present—another reason for not adding steam for dealing with clinker troubles.

The rate of steam decomposition by coke is shown in Fig. 4. The percentage decomposition can be deduced from figures given by the late Prof. Bone, as follows:—

| Steam saturation temp. of blast °C. | Lb. of steam in blast per lb. of coal gasified. | % Steam decomposed (approx.) | Lb. of steam decomposed. |
|---|---|---|---|
| 45 | 0.20 | 100 | 0.20 |
| 50 | 0.21 | | 0.21 |
| 55 | 0.32 | | 0.32 |
| 60 | 0.45 | 80 | 0.36 |
| 65 | 0.55 | | 0.44 |
| 70 | 0.80 | 60 | 0.48 |
| 75 | 1.10 | 50 | 0.55 |
| 80 | 1.55 | 40 | 0.62 |

It is then clear that the temperature falls considerably in the primary reduction zone due to the endothermic reactions and also, but to a lesser extent, in the secondary reduction zone. At the top of the fuel bed where the fuel is fed in, if the fuel is bituminous coal, volatile matter from the distillation of this coal will be added to the gas and the calorific value will increase by reason of the addition of combustible gases from this source. Probably distillation gases continue to be added right into the primary reduction zone because a fairly high temperature of the order of 800°—1000° C. is needed to drive off the last of the volatile matter from the coal. The important thing to notice is that all through the secondary reduction zone, the distillation zone, and into the gas space the temperature is

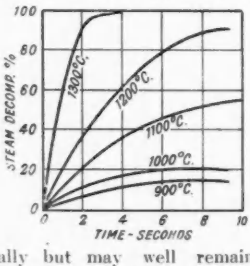


**Fig. 4. Time-temperature reactions in the decomposition of steam by coke**

falling continually but may well remain above 500° C. At the producer outlet the temperature may be of the order of 450°—500° C. or higher. Consequently throughout the travel of the gases along this zone it may be that the reaction between steam and CO is increasing in the direction from left to right with formatin of $CO_2$. Obviously the temperature should be decreased below 500° C. as quickly as possible in order to prevent this reverse reaction from taking place. This can be effected by wet fuel.

The zones in a gas producer are not horizontal, as depicted in Fig. 1, but cone-shaped, the apex of the cone lying towards the centre of the fuel bed. Cooling of the gases at the edges, for example by water walls which are frequently used in modern producers, may be expected to reduce the extent of the primary reduction zone and thus to lead to gas high in $CO_2$ and in undecomposed water from the periphery of the fuel bed. To what extent this happens in practice is a little doubtful because in many producers the air and steam are not introduced over the whole of the bottom of the producer, but through a cone in the centre, and thus the various zones, so far from being cylindrical as here shown, consist of a number of cones superimposed on the central air-steam inlet.

*(To be continued.)*

## AMERICAN IMPORT CONTROL

Further commodities are placed under import control in the U.S. by an amendment to the General Imports Order, M.63, which becomes effective on July 2. The chief commodities of interest to the chemical industries are as follows:—

List 1 (Commodities which may be imported only by special authorisation of the Director of Industrial Operations. Imports of these may continue to be made under existing contracts if these are immediately reported. After importation, the commodities cannot be dealt with in any way except by Government authorisation): beryllium metal, ore, and salts; castor oil; cod-liver oil; corundium; cottonseed oil; glycerine; graphite; lead; linseed oil; oiticica oil; groundnut oil; quebracho; mercudy; rutile.

List 2 (As List 1, except that these commodities may be dealt with without restriction): aluminium scrap; antimony; asbestos; chronium; copper; copra; ferrous scrap; cyanite and sillimanite; lead scrap; mica; mercury ores and concentrates; palm oil; rapeseed oil; shellac; tin scrap; tung oil; tungsten; vonadium ore.

List 3 includes commodities which may not be imported without authorisation, even if under existing contracts; after importation, however, they may be disposed of without restriction: bromine compounds; casein; charcoal; fluorspar; glass; giue (animal and vegetable); ilmenite; iodine; thorium ores; sodium and potassium nitrates.

# Metallurgical Section

Published the first Saturday in the month

# Metallurgical Section

July 4, 1942.

## The Jointing of Metals by Fusion*

### Value of Different Methods of Heat Application

IT is fairly reasonable to assume that the first jointing of pieces of metal (other than mechanical jointing) was done by "autogenous soldering," that is by sweating two pieces of metal together in a fire. A good deal of skill was required to avoid undue burning and consequent sponginess of the metal, and even so the joints were unsightly and required a good deal of grinding and finishing. As the metals with which the early craftsmen worked occurred naturally, or alternatively were produced by fairly crude refining methods, they varied slightly in composition and melting point. No doubt these slight differences were soon taken advantage of and "hard soldering" developed, which enabled joints to be made without sweating and spoiling the parts to be joined. The discovery of tin and lead dates from the time of the Egyptians (though there seems to have been some confusion at times in their minds as to whether they were essentially the same metal). It can easily be imagined how they soon discovered that two pieces of metal of high melting point could be joined by dipping them into molten lead and "blobbing" them together.

#### Work of the Ancients

The art of jointing, however, soon became highly developed and the work of some of the ancients reveals it in some of its most wonderful forms. The Greeks of 1400/400 B.C. were noted for a distinctive type of decorative gold work covered with grains of metal—granulation work; the Etruscans were noted for a very fine form of open wire work (filigree) and produced some very delicate articles indeed. The patient resourcefulness of H. A. P. Littledale enabled him to copy their work, and in a paper at the Goldsmith's Hall, in 1936, he modestly described his efforts. It is proved beyond doubt that the only way they could have produced their fine articles was by sticking them together with a mixture of glue and verdigris. On heating, the carbonaceous matter reduced the copper carbonates and oxides to metallic copper, which alloyed with the gold to form small local quantities of gold-copper alloy of minimum melting point which soldered the parts together at a low temperature. Overheating, which would have at least caused the articles to sag, was avoided. The small quantities of gold-copper alloy of minimum melting point instantly thickened up by dissolving more gold, and consequently did not spread too far and spoil the appearance of the articles. It is very interesting to note that this process was lost through the ages and its re-discovery is very recent.

Many years ago, therefore, the art of mixing metals to produce alloys of much lower melting point was applied, perhaps quite unconsciously. Nevertheless, it does constitute the foundation of soldering principles. Advances in the jointing of metals have been dependent on (1) development in the technique of applying heat, and (2) metallurgical progress.

#### The Process of Jointing

It is convenient now to turn to an examination of the process of jointing. Any molten metal that is applied must be able to run freely, but unless it is a pure noble metal, oxides will form on its surface. These must either be prevented from forming, or must be dissolved or "fluxed" away. Also the molten metal must be able to "wet" the metal to be joined. That is, it must be able to satisfy some unsatisfied condition at the surface to be joined. In general it may be said the surface of a metal in a chemically clean condition is in an unsatisfied state, and the metal becomes more active as temperature is increased. It will satisfy this condition by forming oxides if allowed to, in which case it cannot be wetted unless the melting point is reached, when the oxide film will rupture and, we hope, will float out of harm's way.

Joints can be classified into those where the jointing material definitely alloys with the parts to be joined, and those where practically no alloying occurs and where the joint appears to be mechanical, like the sticking of glass with glue. In the first group, the solder absorbs good quantities of the metal that is being joined and vice-versa. In the second group, soft soldered steel joints and copper brazed steel joints are ideal examples. The question of alloying is important because it has a direct bearing on design of joints, that is the clearances and gaps that

* From a paper by A. E. Richards, B.Sc., presented to the Electrodepositors' Technical Society, London, *J. Elec. Tech. Soc.*, 1941, 17, 45-74).

should be arranged. The phenomenon of capillary attraction is a result of wetting and solder will find its way even against gravity forces into gaps of small clearance like water rising up capillary tubes. If alloying does not occur or is only limited, the capillary effect remains unimpaired and is very striking. Where there is alloying, however, the ability of the solder to flow or penetrate decreases as it dissolves the parent metal and thickens up. Consequently, capillary action ceases sooner and the clearance and design of the joint is affected. Alloying, however, must be kept within reason, as it may lead to "rotting" of the parent metal.

## Welding Temperature Zones

The burning of gases in its simplest form, for example the Bunsen flame, is still the basis of modern technique in applying heat. The Bunsen flame consists of three zones. With the modern blowpipe, the relative areas of the zones can be varied infinitely. The flame temperatures available are: Coal gas and air, say, 1100° C; coal gas and oxygen, 2100° C; hydrogen and oxygen, 2400° C; oxy-acetylene, 3200° C. But these must be interpreted rather as maximum flame temperatures and it does not follow that the flames are really capable of any jointing operation up to those temperatures. The latest flame method is the atomic hydrogen arc, in which hydrogen is dissociated into atoms by passing it between tungsten electrodes. The atoms re-combine a short distance away and produce a flame of great intensity between 3500° C. and 4000° C. Oxidation and scaling are entirely prevented. It will, no

**Fig. 1.—"Easyflo" joint in Monel showing joint where alloying occurs (×225).**

doubt, be responsible for advances in welding some of the more refractory metals.

Electric arc methods are an improvement over flame methods in so far as they are faster and cheaper for repetition work, and the heat is more intensely localised, and subsequently there is less distortion and general oxidation of the work.

Carbon arc is the older process and consists in striking an arc between a carbon electrode and the metal parts to be joined. The arc is focussed at the seam or point to be joined by an electro-magnet in the carbon holder—otherwise it might wander. As much as 100 ft. a min. of 1/16-in. steel sheet can be welded by this means. No fusion metal need be used, but if required it is placed in position beforehand. So-called "autogenisers" are sometimes fed into the arc to provide a protective atmosphere and produce the necessary flux. The method is now applied to soft soldering repetition work because it is so rapid.

Metallic arc, in which an arc is struck between the filler or welding material and the metal to be joined is another process. The arc fuses the end of the filler rod, which also heats up along its length owing to the current it carries. If the filler rod is not large enough to carry the current, premature fusion will

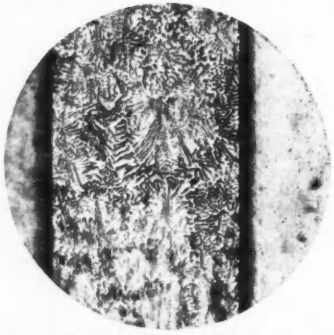

**Fig. 2.—"Easyflo" joint in mild steel showing joint where practically no alloying occurs (×225).**

cause pieces to drip off and inclusions may occur. Metallic arc welding was first confined to ferrous work, but is now extensively applied to non-ferrous metals. Here, flux-covered electrodes are most desirable as the molten metal is liable to oxidise badly as it dips on to the joint.

Electric resistance methods, which are a specialised and involved subject, can be roughly subdivided into:

*Spot Welding.*—Two pieces of metal are placed between water-cooled copper or copper alloy electrodes under pressure. A heavy current at low voltage is generated and a temperature gradient is created. Fusion at the interface subsequently occurs because this is the point at which the cooling effect of the electrode is least, and the electrical resistance is highest.

*Projection Welding.*—If a series of projec-

tions are raised on material, a larger electrode surface can be used. The current eventually has to go through the projection and as a result the current density is increased locally and fusion and welding results.

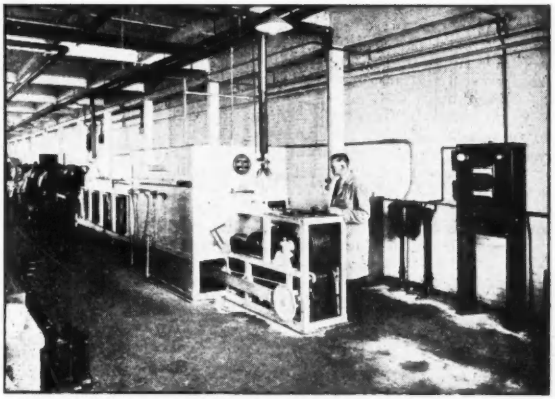

**Fig. 3.—Copper brazing furnace.**

*[By courtesy of Birmingham Electric Furnaces Ltd.*

*Steam Welding.*—If instead of pointed electrodes we use rollers which rotate while the work is fed between them, a seam may be made. To avoid the building up of heat that occurs when the current is passed continuously, and to take care of variations caused by irregularities of the thickness of the sheets, the current is automatically intermittently interrupted. In this way a series of overlapping spot welds are produced and the method is then known as "intermittent seam welding."

*Stitch Welding.*—Rollers cannot be used in inaccessible places. Ordinary pointed electrodes, which open and close repeatedly, can be used to give a stitch effect.

*Butt Welding.*—In this process, which is largely employed for the jointing of strip and wire, the pieces of metal are lightly held together in vice-like electrodes, one fixed and the other movable. A heavy current is passed and heating occurs largely at the interface, owing to the high resistance there. At the right moment the current is switched off and the parts are pushed together under high pressure, and a bulge, which can be ground off, is produced. The upsetting action hardens the material, giving a wrought structure. This process is made use of in the wire-drawing industry for joining up lengths of wire—even copper.

*Flash Butt Welding* is similar, except that the parts to be joined are intermittently brought together and separated. Arcing causes intense local heating to occur and the parts are then pushed together smartly. A third application of electric resistance methods is furnished by those designed primarily for soft soldering and brazing: (1) where copper electrodes are clamped to the work and a current is passed through the mass, heat being generated at the interface where resistance is high, and (2) where carbon electrodes are clamped to the job. These become red-hot themselves and impart heat by conduction and radiation.

*Dip Methods,* in which the parts to be joined are dipped into a bath of molten metal (soft solder or blazing alloy) to assure good penetration into the joint.

*Furnace Methods,* in which the solded is previously placed in position and the work is passed through a furnace. The whole job is heated right through so that if the job is required to retain any workhardness the process cannot be used.

## Brazing and Plating

In copper brazing the amounts of copper are accurately calculated and excess of metal is negligible. The extraordinary penetration of the copper by capillary action is a feature of the process. Surface decarburisation of the steel parts due to the effect of hydrogen can be prevented by copper plating beforehand.

Plating is usually the final operation because either the plate interferes with the jointing process or the plate is spoiled during the operation. Nevertheless, this is not always so, and it is very often more economical to join up plated parts, e.g., steel sheets, than to plate the final article.

Jointing methods form a subject of prime importance to the plater and metal finisher. They are having a direct effect on modern design, particularly in engineering, and it can be said that the shapes which ultimately go to the finisher are becoming more and more complex. It is desirable that the plater and finisher should have some knowledge of how the articles he handles are produced and this paper is intended to fulfil that need at least in part.

# Aluminium Production

## New U.S. Plants

THREE new Government aluminium plants have started operations so far this month in the U.S.A.; a fourth is expected to begin production soon and the entire first expansion programme of seven plants will be in production by August 1, according to Mr. A. H. Bunker, chief of the Aluminium and Magnesium branch. All seven plants will have been completed ahead of schedule, the first three having been finished in six months, as compared with a normal building time of eleven months. The plants are expected to reach full production in from 60 to 120 days after completion, according to their size.

The completed plants are located in Oregon, Washington, and New York. The Alabama plant will be completed next, followed by others in Arkansas, California, and a second plant in Washington, in that order. All were built for the Government by the Aluminium Company of America, which also will operate the plants. Plants in the second expansion scheme, likewise of 640,000 lb. annual capacity, will start coming into production about December next. The flow of aluminium metal is expected to increase every month from now until the early part of 1943, when the aggregate aluminium producing capacity as planned by the War Production Board will be operating at its peak.

The Board is erecting five Government-financed detinning plants and subsidiary plants of putting " green " or dirty cans in condition for detinning operation. These plants will be situated at New York, Buffalo, Chicago, Dallas and Los Angeles, and from them approximately 2000 tons of tin a year should eventually be recovered.

# Standards for Metals

## Raw Copper

SINCE 1924, when a series of British Standard specifications for raw copper was issued, bearing the reference numbers 198-203, it has been found that the classification for copper then adopted was not very satisfactory and did not fit in with the requirements of industry. Accordingly, when a reprint of the specification became necessary, it was decided that a new series, based on the classification at present adopted in industry, should be developed and that the existing British Standards numbers should be withdrawn. B.S. 1035, for raw copper, which has just been issued, includes this new series. This provides for cathode copper, for high conductivity copper produced electrically and by a fire-refined process, and for three grades of tough pitch copper in which conductivity is not specified.

The specifications include requirements relating to surface defects, dimensions, and tolerances on dimensions and marking. The procedure to be adopted in dealing with disputes is also outlined. A note states that a complementary document dealing with methods of sampling and of chemical analysis for the determination of impurities is also in preparation and should be available shortly.

It is proposed that, as the various British Standards for copper products are revised, reference will be included to the appropriate specification for raw copper.

## Structural Steel

The revision of the series of British Standard specifications for steels has now been completed with the issue of B.S. 13, which covers structural steel for shipbuilding. The principal modifications introduced in the revision of this standard are as follows:

(a) A maximum limit of 0.06 per cent. of sulphur and of phosphorus has been imposed and a sulphur print test is required for rivet bar material. A dump test for rivet bars is also required.

(b) The clause on freedom from defects has been amended by the inclusion of requirements which stipulate freedom from harmful segregation of impurities and prohibit patching or welding.

(c) The ultimate tensile stress for plates (other than for cold flanging), originally 28 to 32 tons/sq. in., and for bars and sections, originally 28 to 33 tons/sq. in., have been amended and now include two ranges, namely, 28 to 33 and 26 to 32 tons/sq. in. The purchaser is required to specify which range he desires when placing his order. For plates intended for cold flanging the percentages of elongation, originally 16 per cent. for thicknesses under $\frac{3}{8}$ in. and 20 per cent. for $\frac{3}{8}$ in. and over, have been made 19 and 23 per cent. respectively.

(d) Temper bend tests are no longer required and a reduction has been made in the number of cold bend tests required for bars and sections.

Copies of either of these specifications may be obtained from the British Standards Institution, 28 Victoria Street, Westminster, London, S.W.1, price 2s. 3d., post free.

**Copper deposits** in the Adak mine in West Bothnia (Sweden) having proved of much larger extent than had been estimated, the Government has authorised an appropriation of 3½ million kronor for the erection of a concentration plant there. If approved, the plant will be completed within two years. The Government has transferred its rights to operate the mine to the Boliden Co. on a basis of 25,000 metric tons of ore a year; it is now proposed that this quantity be doubled.

# Hard Facing to Reduce Wear

## Value of the Electric Arc Process

IT is difficult these days to overstress the importance of employing to the full every means of economy in the use of machine tools and parts. The utmost value must be sought from every unit of labour and where the length of life of machine components can be increased there can be found a saving of man-power which is often more considerable than is generally realised. The replacing of a worn part that is not easily accessible can involve an amount of work in dismantling and re-erection which seems out of all proportion to the small adjustment made, and the delaying for as long as possible of this measure must be considered an urgent part of our war economy. This is not to say, of course, that plant in want of repair can be left until its efficiency is reduced. We could hardly afford that kind of "economy." The solution of the problem is to be found rather in the lengthening of the life of those parts of the machine which are subject to most wear.

### Demand for Alloys

Present demands for alloying elements is far in excess of their availability and this has led the writer of an interesting booklet entitled "Hard Facing with Murex Electrodes," published by Murex Welding Processes, Ltd., to set out in some detail the scope of the electric arc process of depositing layers of hard metal on machine parts to make them resistant to wear and abrasion as well as in certain instances to provide cutting edges. It is claimed that in some applications the reconditioned parts can withstand service conditions better than the original parts.

### Degrees of Hardness

A dozen typical applications of hard facing to engineering tools and other materials are dealt with in the booklet. It also gives details of the degree of hardness which can be expected from deposits of different Murex electrodes and some classification of the electrodes according to the type of work for which they are suitable. These types range from lightly alloyed electrodes used for reinforcing medium carbon steels and railway tracks to austenitic alloy electrodes used for building up lips of dredger buckets and manganese rail crossings. Electrodes suitable for giving weld metal of about 600 Brinell hardness are also dealt with. One of the latter type of electrodes is particularly adapted to cutting applications, such as woodworking tools, and shearing blades and dies, where the cutting edge is not subjected to high temperatures, while another deposits a metal similar to high-speed steel and is suitable for topping mild steel shanks to form lathe tools.

### Special Applications

In reviewing the special applications of the process, the writer discusses a group of beater blades for pulversing machines which rotate at a speed of 3000 r.p.m. These blades when badly worn are built up almost to size with a mild steel electrode such as "Medex," and hard faced with "hard surfacing" type electrodes. An application in which the weld metal is work-hardened by subsequent use is the deposition of weld metal on to valve seats. The body of the valve can be made as an ordinary steel casting, and at the same time the valve seat will possess a much greater resistance to wear and erosion than would be possible with cast steel. Hard facing of this type, which is subjected to a compressive or rolling action in service, is usually carried out with "manganese" electrodes. If the amount of weld metal is small and the expense justified, austenitic metal, such as is produced by Murex "Nicrex," can be used or, alternatively, "Staybrite" types such as "F.S.L.," etc.

### Longer Life for Valves

Steam and liquid valves of the screw-down type, with circular seatings, can be made to give a considerably longer life, it is claimed, if the seat is built up of "Nicrex" or similar weld metal. The usual procedure is to turn back a groove to receive a sufficient thickness of the austenitic weld metal and fill up with one run of a suitable size of electrode. Valves up to 4" in diameter can usually be built up with No. 10 gauge electrodes, and up to 6" in diameter with a single run of No. 8 gauge electrodes. Larger valves, where the face of the valve seat exceeds ⅝" width, require multiple runs side by side. The built-up seating can easily be machined, and if care is taken with the start and finish of each bead, perfectly sound weld metal free from porosity can be deposited. In addition to being a satisfactory form of repair to worn valves, this treatment can be applied to new valves before putting them into service in order that their life might be extended.

# Low-Grade Chromium Ores

## New American Metallurgical Processes

NEW methods for the treatment of low-grade chromium ores come from America. The Bureau of Mines has announced a new metallurgical process for the large American deposits of low-grade chromite ores which has been developed as the result of years of research and experiment. It has successfully passed all tests made so far and has thus proved worthy of large commercial production. Definite recommendations for the construction of commercial plants will be made when final data are received on additional tests now being made. This new method, a roasting and leaching process, which is designed to convert chromite concentrates into a higher grade of material providing either high-purity chromium or standard ferrochrome for the manufacture of alloy steel, was developed in the Bureau's laboratories at Boulder City, Nevada and Salt Lake City, Utah, under the direction of Dr. R. S. Dean, Chief of the Metallurgical Division. It is capable not only of increasing the chrome content of the ore but can also raise the ratio of chromium to iron from about 1.7 to 1 up to as much as 30 or 40 to 1.

Vast deposits of low-grade chromite reserve ores in Montana, estimated at 2½ million tons, and deposits of similar ore in other Western States, are expected to furnish the raw materials for concentration plants and proposed processing plants. The Montana deposits are believed to contain enough chromium to yield over 900,000 tons of chromite (concentrates containing 45 per cent. or more chromic oxide) of a grade suitable for making ferrochrome.

### Industrial Uses

While the main industrial use of chromium is in the metallurgical field of alloys, it is important also as a refractory in furnace construction. In some cases the entire furnace hearth has been built of chromite, but the more common application is as an insulating layer between a basic hearth and an acid roof, since the chromite is neutral in composition and will not react with either hearth or roof.

Utilisation of the low-grade chromite ores of Montana and the Pacific Northwest has been a problem of interest to the Bureau of Mines for a number of years. Removal of an excessive amount of iron from the ores was the chief metallurgical problem, according to Dr. Dean, whose experiments have shown that this can best be accomplished by the roasting and leaching process. In this method, after the chromite ore concentrates are received from mining and concentration plants, they are mixed with coke and treated in a rotary kiln especially designed by Bureau of Mines metallurgists. The material thus treated is cooled, and part of the iron is removed by gravity concentration or by magnetic methods. Additional reduced iron may be removed by leaching with sulphuric acid or sulphur dioxide, leaving the residue enriched in chromium. The extraction of iron may be controlled by controlling the leaching time and roasting conditions. The Bureau's research indicates that it probably will be most economical to produce a residue having a 5 :1 chromium/iron ratio. This will permit mixing of 2 tons of residue with 1 ton of raw concentrates to produce a product having a chromium/iron ratio of 3 :1. This product of the Bureau's process may then be reduced directly by electric furnace to produce standard ferrochrome containing about 70 per cent. chromium.

### Enriching the Ores

A method of enriching low-grade chromium ores hitherto regarded as uneconomic has been devised by A. J. Gailey, of Niagara Falls according to U.S. P. 2,277,220. This has been assigned to the Electro-Metallurgical Company of West Virginia. Ores in which the ratio of chromium to iron is less than three to one are too poor for the production of tough, high-speed ferrochrome alloys. Such ores, the inventor asserts, can be enriched by the use of a combined chlorine and carbon monoxide gassing treatment.

The ore to be enriched is first crushed and screened to proper size. Packed into a reaction tower, it is then heated to above 600° C., while carbon monoxide and chlorine are percolated through it. Under these conditions, it is explained, the chlorine attacks the iron oxide, converting it into ferric chloride. The latter is volatile at the reaction temperature used and is "washed out" by percolating an excess of the chlorine carbon- monoxide mixture through the ore. The chromium oxide present in the ore, on the other hand, is not attacked by the chlorine. Since it is not volatilised it remains behind in the ore while the iron is driven off. In this way the ratio of chromium to iron in the ore is increased.

# Chemical Progress in Eire

## Seaweed Products Developed

FURTHER possibilities in the use of seaweed are dealt with in a recent research report of the Irish Industrial Research Council. It is stated, for example, that a product was prepared which, on being tested by a commercial firm, was found to be a satisfactory alternative to sago flour in the sizing of twine. The value of this material as a substitute for starch is also being investigated. Experimental work has been conducted on the utilisation of algin for the production of water-proofing agents and plastic materials, as well as for alginate films and filaments. Experiments on the manufacture of ethyl alcohol from seaweed have shown that yields equivalent to between 13 and 16.9 gallons of alcohol per ton can be obtained from air-dried autumn weed. Seaweed from which the salts had been extracted produced a board with a good appearance and ability to hold nails and screws. The Building Research Station of the D.S.I.R., London, reported that the boards were suitable for many commercial purposes.

A pilot plant operating at Cork is recorded as having obtained, by means of a solvent extraction process from air-dried peat, yields of wax varying from 7 to 11 per cent. by weight of the quantity of anhydrous peat.

### Industrial Chemicals

Acetic acid, acetone, and methyl alcohol are being produced in Eire for the first time, by Motol, Ltd., a company originally founded to explore the possibilities of securing a substitute motor spirit. Part of the methyl alcohol output is being utilised by the Irish Industrial Alcohol Co. for the manufacture of formalin. Carbon dioxide for industrial uses is now being obtained in Dublin by the tapping of one of the fermenting tuns of Messrs. Guinness's brewery. A four-stage compressor has been installed and the gas rising from the vats during the fermentation of the barley and yeast is being drawn off. Mr. S. W. Aitken, managing director of the tapping company —Industrial Gases (I.F.S.), Ltd.—states that he hopes to produce two tons of $CO_2$ per week.

### Barytes Production

The development of a barytes deposit, on the Sligo-Leitrim border, of a quality suitable for the manufacture of lithopone for oil-drilling purposes, is likewise of interest. The deposit, which is being mined by Benbulben Barytes, Ltd., is in a fissure 7 ft. wide, and has been traced and opened up for a distance of about 1½ miles. The outcrop is approximately 2000 feet above sea-level, and the mineral has been found to be compact down to the 1250-foot level. During the past year, over 5000 tons of crude material have been extracted, the mineral, on the average, being as white as the best grades from various European mines. Analyses at various points have shown from 96 to 98 per cent. $BaSO_4$; the other main constituent is silica. Supply contracts are stated to have already been placed with British paint firms.

It is understood that the Minister for Industry and Commerce is making plans for the reorganisation of industrial research in Eire. He has stated that the financing of the work must be carefully considered and considers that, apart from State aid, some support should be forthcoming from the owners of industrial concerns who would naturally be expected to derive the greatest and most immediate benefit from such research work.

## DEFECTS IN GLASSWARE

At the last ordinary general meeting (the 216th) of the Society of Glass Technology, held at Sheffield in the latter half of last month, a consideration of the available methods of estimating two of the main types of defects in glassware—cordiness and surface defects—was presented by Dr. A. J. Holland, Dr. Eric Preston, and Professor W. E. S. Turner. Results show that a "figure of merit" in the tests for "cord" can be best obtained by the direct shadow method, which was extremely sensitive: the polariscope was found less sensitive; but a photo-optical method of good reliability was in the development stage. This last would depend only on the accuracy of the apparatus employed and would be free from the personal factor of the observer, but more sensitive equipment than at present available was required. In addition, a thermostatically controlled centrifuge had been set up for separating glass of different densities from finely powdered samples, whereby an estimate of "cord" could be obtained from readings of the density distribution.

A general comparison of surface condition could also be made by a shadow method, but here an optical method was to be preferred, and a scheme was in hand for a method of this nature which would give a value independent of the observer's judgment. Although it was not to be expected that such a method would be highly sensitive, owing to the minuteness of surface unevennesses, it should serve to distinguish between good and bad surface conditions generally.

# Personal Notes

VISCOUNT WEIR—director of I.C.I. and the International Nickel Co. of Canada—has been appointed chairman of the Tank Board set up by the Ministry of Supply.

MR. JOHN WILLIAM BUCKLE, governing director of Buckle, Crossley & Co., Ltd., of Victoria Dyeworks, Bradford, and of Manchester, died in a Bradford nursing home on June 26.

CHIEF ENGINEER ALEXANDER B. HOWE, Merchant Navy, who has been awarded the O.B.E., for bringing a torpedoed ship into port, was before the war employed as an engineer at the Anglo-Iranian Oil Refinery, Llandarcy.

MR. WILLIAM JOHN FERRIER, who died at Edinburgh on June 18, was well known in the chemical and allied trades in East Scotland, having been a director of Wight and Co. (Leith), Ltd., chemical manufacturers and chemical manure makers.

FLIGHT-LIEUT. DESMOND BOOKER, who last week was awarded the D.F.M. for attacks on enemy dockyard towns and industrial centres, was before the war on the staff of the Imperial Chemical Industries, Ltd., London.

MR. FREDERICK S. KERNICK, director of Kernick and Sons, Ltd., Cardiff, and a past-president of the South Wales branch of the Society of Chemical Industry, has been elected president of the Cardiff Chamber of Trade for the ensuing year.

MR. RUSSELL G. PELLY, F.I.C., chemist to the Southend Waterworks Co., has kindly consented to give the Twenty-fifth Streatfield Memorial Lecture, and will deal with the subject of "Water Purification" or "Water Treatment." A more detailed announcement will be made in due course by the Institute of Chemistry.

PROFESSOR PERCY F. FRANKLAND, F.R.S., C.B.E., and Mrs. Frankland, have celebrated their diamond wedding. Both are 85 years of age. Professor Frankland is an authority on bacteriology, and was Professor of Chemistry at University College, Dundee, and Mason College, Birmingham.

DR. GUSTAVE WHYTE THOMPSON, chief chemist of the National Lead Co., Brooklyn, U.S.A., from 1892 until his retirement in 1938, died recently in Brooklyn, aged 76. He became a director of the National Lead Company in 1916, and was also a director of many of its subsidiary corporations. In 1926-27 he was vice-president and in 1928 president of the A.S.T.M.

MR. R. A. WHITHERSPOON has been awarded the Society of Chemical Industry (Canada) Medal for outstanding achievement in the electrochemical field. Mr. Whitherspoon was formerly chairman of the Executive Committee and president of Shawinigan Chemicals, Ltd., and has been connected with the Shawinigan interests in various executive capacities since 1904, retiring from active participation in the company's affairs last March.

Among the prominent industrialists who have been appointed chairmen of the Regional Boards for war production are MR. HAROLD H. BERRESFORD, J.P., of Staveley Coal and Iron Co., Ltd. (North Midland), and VISCOUNT RIDLEY (Northern) who was Director of Producer Gas Vehicles in the Ministry of War Transport. SIR ALFRED FAULKNER has been appointed Director of Producer Gas Vehicles in succession to Viscount Ridley.

# New Control Orders

## Fertiliser Prices

It has been decided to continue the stabilisation of fertiliser prices for the season 1942/43, and the Minister of Supply has accordingly made the Control of Fertilisers (No. 23) Order, 1942, and a General Direction thereunder, whereby the existing maximum prices for sulphate of ammonia, superphosphates, ground phosphate and compound fertilisers are maintained. The control of sulphate of ammonia prices has also been extended to Northern Ireland. Provision has again been made for substantial early delivery rebates; and by the Control of Fertilisers (No. 21) Order, 1942, Direction No. 1, early delivery rebates are granted on triple superphosphates. Both the Order and the two Directions (S.R. & O. 1942, Nos. 1216-1218) came into operation on July 1.

## Iron and Steel

The Control of Iron and Steel (No. 23) Order, 1942 (S.R. & O., 1942, No. 1189), which came into force on June 22, amends the previous orders, Nos. 15-20 and 22, by allowing the material mentioned in the first schedule to No. 15 and subsequent Orders to be produced by a person not normally a producer of that material, or to be produced by unusual methods, whenever the maintenance of essential supplies and services so demands. Prices in excess of the maximum prices in force may be charged for such material, in circumstances similar to the above, provided that the Minister of Supply deems these prices reasonable.

## Imported Potash Salts

The Imported Potash Fertiliser (Rates of Application) Order (S.R. & O. 1942, No. 1207), which also came into force on July 1, regulates the use of imported potassium salts as fertilisers. Specified crops and specified amounts are laid down, and no divergence from these is permitted, except under special authority issued by a County War Agricultural Executive Committee.

# General News——— ———From Week to Week

**The Ministry of Food** announces that there will be no change in the existing prices of oils and fats allocated to primary wholesalers and large trade users for the five weeks ending August 1.

**On and after July 1,** any user of tyres who is entitled to buy a tyre under the Tyre Rationing Scheme will receive payment for the old tyre he surrenders if it is fit for retreading. Prices will range from 5s. for car sizes to £2 for the largest giant sizes.

**That road transport operators** installing producer gas units in their vehicles should be compensated for the capital outlay involved is the suggestion of the Mansion House Association on transport. This and other proposals designed to ensure conservation of our petrol resources have been placed by the association before the Ministry of War Transport.

**Students of colloid chemistry** are likely to benefit from an offer made to the University of Cambridge by members of the family and a group of friends of the late Oliver Gatty, the brilliant young Cambridge scientific worker, who died on national service in June, 1940. The offer consists of the provision of a fund to endow a studentship which would give an opportunity for scientists of any nationality to carry on their work in the department of colloid science.

**The Chemical Club** will be closed for cleaning from July 13 to 19 inclusive. During that period members will have the hospitality of the West India Club in Whitehall Court. Among other facilities are a bar and a billiard-room. Members of the staff of the Chemical Club will be at the West India Club during that time. These dates have been chosen by the committee so that the Chemical Club shall be in full commission on July 10, the date of the annual general meeting of the Society of Chemical Industry.

**The Federation of British Industries,** in its recent report on reconstruction, stated that industry was prepared to reconsider all the implications of industrial organisation, but that the Government on its side must define its attitude towards trade associations and pursue a consistent policy towards them. An F.B.I. committee has accordingly been appointed to consider the questions affecting the trade association movement of the country and to submit a report to the Federation based upon its study of the problem and the evidence which it receives from its trade association members. Sir Charles Bruce-Gardner has accepted the chairmanship of this committee, which will begin its work at an early date.

**Rationing of liquid soap** started on June 29, and supplies will be divided into two qualities: No. 1, containing more than 12½ per cent. of fatty acids; and No. 2, containing 12½ per cent. or less of fatty acids. Domestic consumers can obtain half a pint of No. 1 quality or one pint of No. 2 quality for each soap coupon. Other consumers of liquid soap must obtain a permit.

## Foreign News

**Arrangements have been worked out** for the American Reconstruction Finance Corporation to finance the development of marginal and sub-marginal mines in Canada for the purpose of relieving the present serious shortage of base metals, such as lead, zinc, and tungsten, in the United States.

**Copper mining** in the State of Vermont, which has been in abeyance for some 15 years, is to be restarted, according to advices from the U.S. War Production Board. A new corporation, the Vermont Copper Company, has surveyed the copper belt there and production will begin as soon as conditions demand it.

**Production of crude copper** and refinery output in the United States during May both established a new high record, it is announced. In order to conserve copper yet further, the War Production Board has prohibited the sale of copper wire screening, a material largely used in the States for porch and window screens.

**The price of wolfram in Portugal** has been officially fixed at 120 escudos (£1 4s.) a kilogram, according to a decree published in Lisbon on June 25. This puts an end to the wave of speculation in this valuable war metal, which has been continuing for many months. The decree further states that all those who mine or search for wolfram or tin without a Government licence will henceforth be liable to imprisonment.

**German requirements of fluorspar** have increased considerably as a result of the war. At Ilmenau (Thuringia), now the most important producing district, a valuable colourless spar is being obtained which is used for making optical lenses. I.G. Farbenindustrie and Rütgers have formed a new company, Flussspatwerke G.m.b.H., with a capital of 800,000 marks for the development of fluorspar deposits in Germany, other European countries and overseas territories belonging to continental states. The two founders have handed over their own deposits to the new company, which will also engage in the manufacture of fluorspar products.

**The Celanese Corporation of America** has received a contract from the Rubber Reserve Co. and the Defence Plant Corporation to construct and operate facilities for the production of synthetic rubber.

**Chromite deposits** in the part of Macedonia annexed to Bulgaria are to be exploited by a German-Bulgarian company it is reported. Deposits with a chrome content of between 42 and 58 per cent. are said to have been located between Ochrid and Veles.

**A new milion-mark company,** Südost-Magnesit G.m.b.H., has been formed by the leading German and Austrian magnesite producers for the establishment, lease, and operation of magnesite plants, presumably in South-Eastern parts of Europe (Austria and Yugoslavia).

**The sixteen "Communists"** shot recently at Mannheim were connected with a large underground organisation operating in the chemical and coal industries, says an official of the Free German League of Culture which is holding an exhibition in London to show how different classes of the German people are fighting Nazism at the core.

**Hydrogenation in Italy** has made progress, according to the annual report of ANIC, and now supplies the country with lubricating oil, transformer oil, paraffin wax, and other products, in addition to those originally obtained. The output of the hydrogenation works is equal to 90 per cent. of the raw material intake, which probably still consists mainly of Albanian crude petroleum.

**The problem of lubricating oil** has become extremely acute in France, according to American reports. Present production, based on anthracenic oils, does not seem satisfactory, and experiments are being carried out with mixtures of castor oil and other vegetable oils, including a new type of oil from fir, which appears to have found favour with the S.N.C.F. (National Railway Co.).

**The Government has decided** to extend its commodity control in West Africa to a number of products such as vegetable oils, oilseeds, ginger, and rubber. All these West African products will be needed for the war effort of this country and of the United States, in view of the huge losses of oilseeds, spices and rubber from the Malayan area. Rubber production is being fostered with the help of ex-Malayan experts.

**In addition to increasing its mining output** of high-grade zinc in Manitoba, the Hudson's Bay Mining and Smelting Co. has installed a pilot plant for recovering metals from the residues that have been accumulating since 1930. Dumps estimated to amount to 300,000 tons, containing 23 per cent. of zinc, are to be treated by the sodium chloride process, for precipitating gold, silver, and copper; the remaining zinc is roasted to yield zinc oxide.

**Prager Chemischer Verein**, the leading chemical manufacturer in the "Protectorate" of Bohemia and Moravia, reports an increase of 30 per cent. in sales for 1941, due largely to the opening of a new plant for organic chemicals. Production and sales of inorganic products were slightly better.

**Steaua Romana S.A.**, the operating company owned by Steaua Romana (British), Ltd., which is now under the effective control of the Deutsch-Rumanische Mineralol G.m.b.H., has increased its share capital from one million to 1½ million lei, by raising the nominal value of the shares from 500 to 750 lei.

**A conference on industrial salvage**, designed to bring together all sections of industry in war production, whether directly or indirectly, was held in New York on June 17. The purpose was to ascertain specific measures for the salvage of such critical materials as rubber, ferrous and non-ferrous metals, plastics, solvents, and other materials in ordinary use in war plants.

# Forthcoming Events

There will be a meeting of the **Institute of Sewage Purification** at Friends' House, Euston Road, N.W.1, at 2.30 p.m., on **July 9**, when papers on "The Manurial Value of Sewage Sludges," and "A Critical Review of Recent Work on Sewage Filtration," will be presented by Dr. E. M. Crowther and Mr. J. Hurley respectively.

The annual general meeting of the **Society of Chemical Industry** will be held at the Royal Institute, Albemarle Street, London, W.1, by kind permission of the managers, on **July 10.** Luncheon will be in two parties, at the Trocadero Restaurant, and at Stewart's, 50 Old Bond Street, W.1. at 12.30 for 1 p.m.; places are being allotted by ballot. The meeting itself will be at 2.30 p.m., followed by the president's address at 3 p.m., and conferment of honorary memberships at 3.30 p.m. Tea will be served in the long library at 4 p.m., and the presentation of the Messel Medal to Sir John Russell at 4.40 p.m. will precede his address, with which the meeting will close.

**The Institute of Petroleum, The Institute of Chemical Engineers,** and the **Chemical Engineering Group** (Society of Chemical Industry), are holding a joint meeting on **July 14**, at 5.30 p.m., in the Institution of Mechanical Engineers, Storey's Gate, S.W.1, when a paper on "The Separation of Gases" will be presented by Dr. M. Ruhemann. Members are cordially invited to bring with them any friends interested, for whom tickets should be obtained from The Institution of Chemical Engineers.

# Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

## Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an*—followed by the date of the Summary, but such total may have been reduced.)

BRITISH DRUG HOUSES, LTD., London, N. (M., 4/7/42.) June 4, debenture, securing to Birchin Lane Nominees, Ltd., all moneys due or to become due from the company to Williams Deacon's Bank, Ltd.; general charge. *Nil. June 24, 1941.

# Company News

**Peter Brotherhood, Ltd.,** report a net profit for the year ended March 31, of £60,387 (£61,969), and have declared a dividend on the ordinary shares of 12 per cent., again making 20 per cent. for the year.

**British Glues and Chemicals, Ltd.,** announce a dividend of 10 per cent. on the ordinary stock and 1 per cent. participation on the 8 per cent. cumulative participating preference stock for the year ended April 30 (same).

# Chemical and Allied Stocks and Shares

STOCK Exchange markets have remained overshadowed by the war news, and in the absence of demand the trend to lower prices has continued, although selling was again only on a moderate scale. The steady market again ruling in British Funds was an important factor assisting sentiment. In some directions, satisfactionwithre centdivi dendan nouncem ents tion with recent dividend announcements was a helpful influence. The continued absence of heavy selling, despite the extent of the rise in some security values shown a few weeks back, indicates general willingness to take more than a short view and also the confidence held regarding the future.

Following last week's decline, Imperial Chemical were steadier, and at 31s. 6d. were, in fact, virtually unchanged on balance; the 7 per cent. preference units, however, eased further to 33s. B. Laporte were again 66s. 3d., and Fison Packard 38s. 9d., but quotations did not appear to be tested by business this week. Boots Drug were easier at 33s. 6d. Lever and Unilever went back slightly to 26s. 6d., a decline of 6d. on balance. Despite satisfaction with the dividend announcement, British Plaster Board eased 6d. to 22s. 6d., while elsewhere Barry and Staines declined on balance from 32s. 6d. to 30s. on the lower payment for the past year's working. Nairn and Greenwich remained at 52s. 6d., but there was a downward movement from 27s. to 26s. 6d. in Wall Paper Manufacturers deferred units. Textile issues, including Bradford Dyers and Calico Printers, were lower, but in other directions Courtaulds had a firmer appearance, the disposition being to await the impending interim dividend announcement.

Among other securities, Allied Ironfounders have remained fairly active on the good impression created by the results, but have not held best prices and are 29s. at the time of writing. Dorman Long ordinary were 16s. 3d., but the preferred ordinary showed improvement to 24s. Stewarts and Lloyds at 46s., and Tube Investments at 82s. 9d., were relatively steady and virtually unchanged on balance. Richard Thomas ordinary, which had recently been attracting increased attention, were 6s. 6d. and the preference shares 24s. 9d. Goodlass Wall held their improvement, dealings up to 11s. having been recorded in the 10s. ordinary shares. General Refractories at 11s. 6d. also kept their recent rise, and British Glues 4s. ordinary were firm around 6s. 3d. on the dividend. In many instances, however, quotations for smaller-priced securities were not tested by business this week owing to the inactive conditions prevailing on the Stock Exchange. Imperial Smelting were again 9s. 9d. Elsewhere, British Industrial Plastics 2s. ordinary were again around 4s. and Erinoid 8s. 3d., while Lacrinoid Products continued to transfer around 3s.

The units of the Distillers Co. were steady and unchanged on balance at 74s. 3d., aided by the maintenance of the 16¼ per cent. dividend which was in accordance with market expectations. Morgan Crucible 5½ per cent. preference transferred at 26s. 3d. and the 5 per cent. preference were 23s. Total dividend requirements of these two classes of preference shares were earned three times over last year, despite the reduced profits shown by the recently-issued report. Relatively steady features were provided by Murex at 90s. and by Turner and Newall at 67s. 9d.,

but on balance British Oxygen went back from 66s. to 65s. and British Aluminium from 43s. 6d. to 43s Monsanto Chemicals 5½ per cent. preference were again 22s. 6d. and Greeff Chemicals 5s. ordinary were around 5s. 6d. In other directions Triplex Glass were 31s. 1½d., but Pinchin Johnson eased from 24s. to 23s. 6d., and United Molasses from 27s. to 26s. 3d. Cellon 5s. ordinary shares were firm and inactive with the quotation again around 16s. Oil shares continued to move lower under the lead of Anglo-Iranian, which were affected by the war news.

## British Chemical Prices

### Market Reports

TRADE in the general chemicals market has been fairly steady during the past week with deliveries against contract commitments well up to schedule. In the soda products section there is a good demand for yellow prussiate, bichromate, and chlorate, and a moderate inquiry is reported for acetate and hyposulphite. Trade in the potash section of the market continues to be restricted by the supply position, and supplies of bichromate, yellow prussiate, and caustic potash are quickly absorbed for priority needs. On the whole the coal-tar products market continues steady, with creosote oil and cresylic acid in strong demand. A fair inquiry is reported for naphthas, but the xylols remain quiet.

MANCHESTER.—Chemical trade conditions during the past week have shown comparatively little change so far as the Manchester market is concerned. The undertone of prices is firm in virtually all sections, and in not a few instances potential buyers are finding it difficult, if not impossible, to secure offers for prompt or near delivery. The big industrial users are mostly taking steady deliveries under existing commitments, the leading soda products, on the whole, being taken up in fair quantities, while in the case of the potash chemicals the turnover is regulated entirely by the parcels available. A fair trade has been done in the ammonia and magnesia chemicals.

GLASGOW.—The Scottish heavy chemical trade business is little changed from last week. Business for home trade still continues to improve. Export business generally is still unrestricted. Prices are very firm with a tendency to rise.

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## PATENTS & TRADE MARKS

THE Owners of Patent No. 412,790 are desirous of arranging by way of Licence or otherwise on reasonable terms for the commercial development in Great Britain of this invention which concerns Improvements in or Relating to Tanning. For particulars address Elkington and Fife, 329 High Holborn, London, W.C.1.

## WORKING NOTICES

THE proprietor of British Patent No. 380,220 is prepared to license British manufacturers to work thereunder. It relates to analytical distillation apparatus. Address: Boult, Wade and Tennant, 112 Hatton Garden, E.C.1.

**The fact that goods made of raw materials in short supply owing to war conditions are advertised in this paper should not be taken as an indication that they are necessarily available for export.**

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